Gas Leak on Converter 1st Pass Outlet

P/P_A = 1.231 less than 1.893 $[(k+1)/2]^{k/(k-1)}$ therefore the flow is non-choked (i.e. subsonic), and the following equation applies

$$Q = CAP\sqrt{(2g_c/ZRT)(K/K-1)[(P_A/P)^{2/K} - (P_A/P)^{(K+1)/K}]}$$

				psia	psig	in WC
Q = mass gas flow (lbs/s)			K = C_p/C_v of the gas	1.4		
C = discharge coefficient	0.65		P = source pressure absolute (lb/ft^2)	2606	18.1	3.4	94
Equivalent Diameter of hole (in)	0.25		P_A = ambient pressure absolute (lb/ft^2)	2117	14.7		
A = area of hole (ft^2)	0.00034		M = molecualr weight of gas	34		
g_c = gravitational constant (ft/s)	32.17		Z = compressibility factor	1.077063		
R = gas constant (ft-lb/lb mol - °R)	1543.3		Release duration (seconds)	3,600		
T = temperature (°R)	1037	303 °C	SO_3 concentration in gas (wt%)	0		
Molecular weight of SO_3	80		SO_2 concentration in gas (wt%)	1.0		
			Molecular weight of SO_2	64		

Intermediate Calculations:

0.00127
3.5
0.74315
0.70031
0.57707

Mass Calculations:

Q =	0.0080 lbs/s
Total mass:	29 lbs
Total SO_3 mass:	0 lbs
Total SO_2 mass:	0.29 lbs

Reference: "Perry's Chemical Engineering Handbook, 6th Edition, McGraw-Hill 1984"

EXHIBIT # _____

DEPONENT _____

TORRES REPORTING & ASSOCIATES, INC
COURT REPORTING & LITIGATION SERVICES
www.torresreporting.com

DSF0001016

Gas Leak on CIP - Cold Side

P/P_A = 1.172 less than 1.893 $[(k+1)/2]^{k/(k-1)}$ therefore the flow is non-choked (i.e. subsonic), and the following equation applies

$$Q = CAP\sqrt{(2g_c/ZRT)(K/K-1)[(P_A/P)^{2/K} - (P_A/P)^{(K+1)/K}]}$$

				psia	psig	in WC
Q = mass gas flow (lbs/s)			K = C_p/C_v of the gas	1.4		
C = discharge coefficient	0.65		P = source pressure absolute (lb/ft^2)	2481	17.2	2.5	70
Equivalent Diameter of hole (in)	0.25		P_A = ambient pressure absolute (lb/ft^2)	2117	14.7		
A = area of hole (ft^2)	0.00034		M = molecualr weight of gas	34		
g_c = gravitational constant (ft/s)	32.17		Z = compressibility factor	1.077063		
R = gas constant (ft-lb/lb mol - °R)	1543.3		Release duration (seconds)	3,600		
T = temperature (°R)	627	75 °C	SO_3 concentration in gas (wt%)	0		
Molecular weight of SO_3	80		SO_2 concentration in gas (wt%)	1.0		
			Molecular weight of SO_2	64		

Intermediate Calculations:

0.0021
3.5
0.79714
0.7618
0.54942

Mass Calculations:

Q =	0.0089 lbs/s
Total mass:	32 lbs
Total SO_3 mass:	0 lbs
Total SO_2 mass:	0.32 lbs

Reference: "Perry's Chemical Engineering Handbook, 6th Edition, McGraw-Hill 1984"

Gas Leak on CIP - Hot Side

P/P_A = 1.172 less than 1.893 $[(k+1)/2]^{k/(k-1)}$ therefore the flow is non-choked (i.e. subsonic), and the following equation applies

$$Q = CAP\sqrt{(2g_c/ZRT)(K/K-1)[(P_A/P)^{2/K} - (P_A/P)^{(K+1)/K}]}$$

				psia	psig	in WC
Q = mass gas flow (lbs/s)			K = C_p/C_v of the gas	1.4		
C = discharge coefficient	0.65		P = source pressure absolute (lb/ft^2)	2481	17.2	2.5	70
Equivalent Diameter of hole (in)	0.25		P_A = ambient pressure absolute (lb/ft^2)	2117	14.7		
A = area of hole (ft^2)	0.00034		M = molecualr weight of gas	34			
g_c = gravitational constant (ft/s)	32.17		Z = compressibility factor	1.077063			
R = gas constant (ft-lb/lb mol - °R)	1543.3		Release duration (seconds)	3,600			
T = temperature (°R)	1113	345 °C	SO_3 concentration in gas (wt%)	25			
Molecular weight of SO_3	80		SO_2 concentration in gas (wt%)	1.0			
			Molecular weight of SO_2	64			

Intermediate Calculations:

0.00118
3.5
0.79714
0.7618
0.54942

Mass Calculations:

Q =	0.0066 lbs/s
Total mass:	24 lbs
Total SO_3 mass:	6 lbs
Total SO_2 mass:	0.24 lbs

Reference: "Perry's Chemical Engineering Handbook, 6th Edition, McGraw-Hill 1984"